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(54) **HEAT DISSIPATION APPARATUS FOR HEAT PRODUCING DEVICE**

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H05K 7/20 (2006.01)
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(58) **Field of Classification Search** 361/694–695, 361/697, 699–704; 165/80.3–80.5, 104.33, 165/185; 174/15.2, 16.1, 16.3; 454/184
See application file for complete search history.

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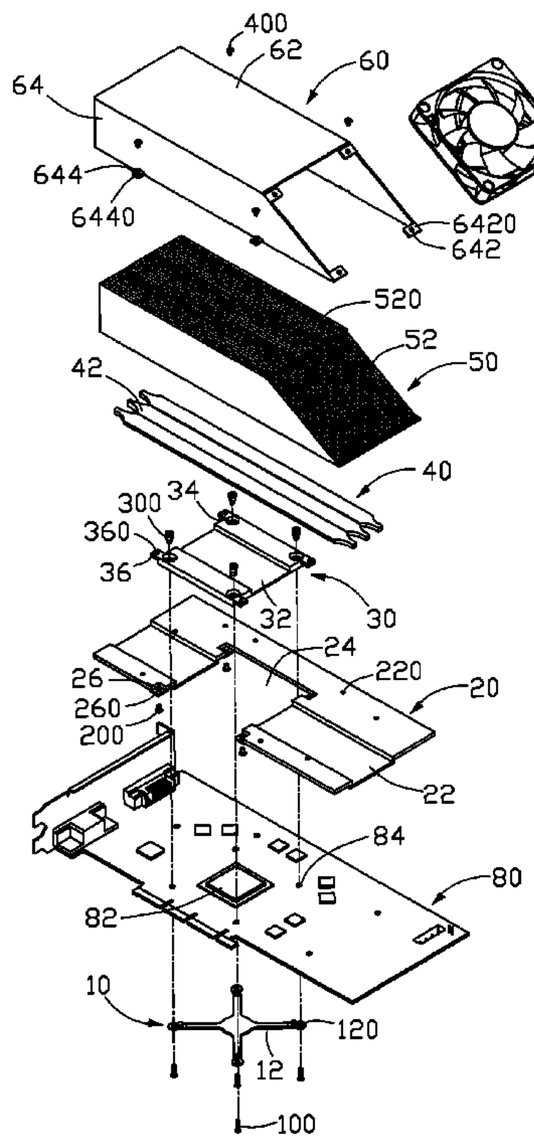
(57) **ABSTRACT**

A heat dissipating apparatus for dissipating heat generated by heat producing device, includes a base, a fin set and an axial fan. The base is secured on the heat producing device. The fin set comprises a plurality of fins arranged on the base; the fins are spaced apart from and oriented parallel to each other, and form a plurality of air passages therebetween. The axial fan is installed at a lateral side of the fin set and directs airflow into the fin set through the air passages. The fin set has an inclined area at an end thereof, and the fan is installed on the inclined area of the fin set and oblique to the base.

15 Claims, 2 Drawing Sheets



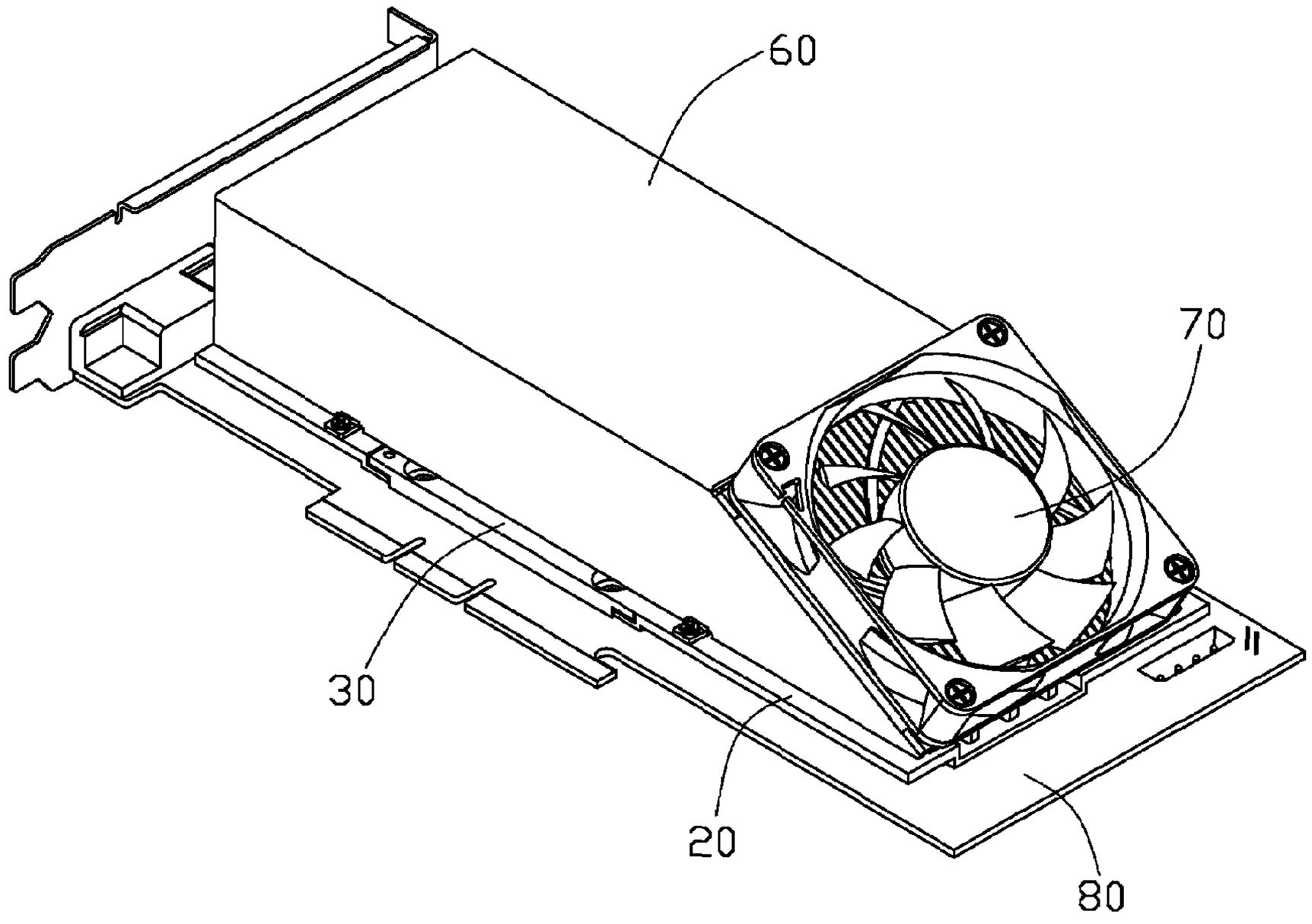


FIG. 1

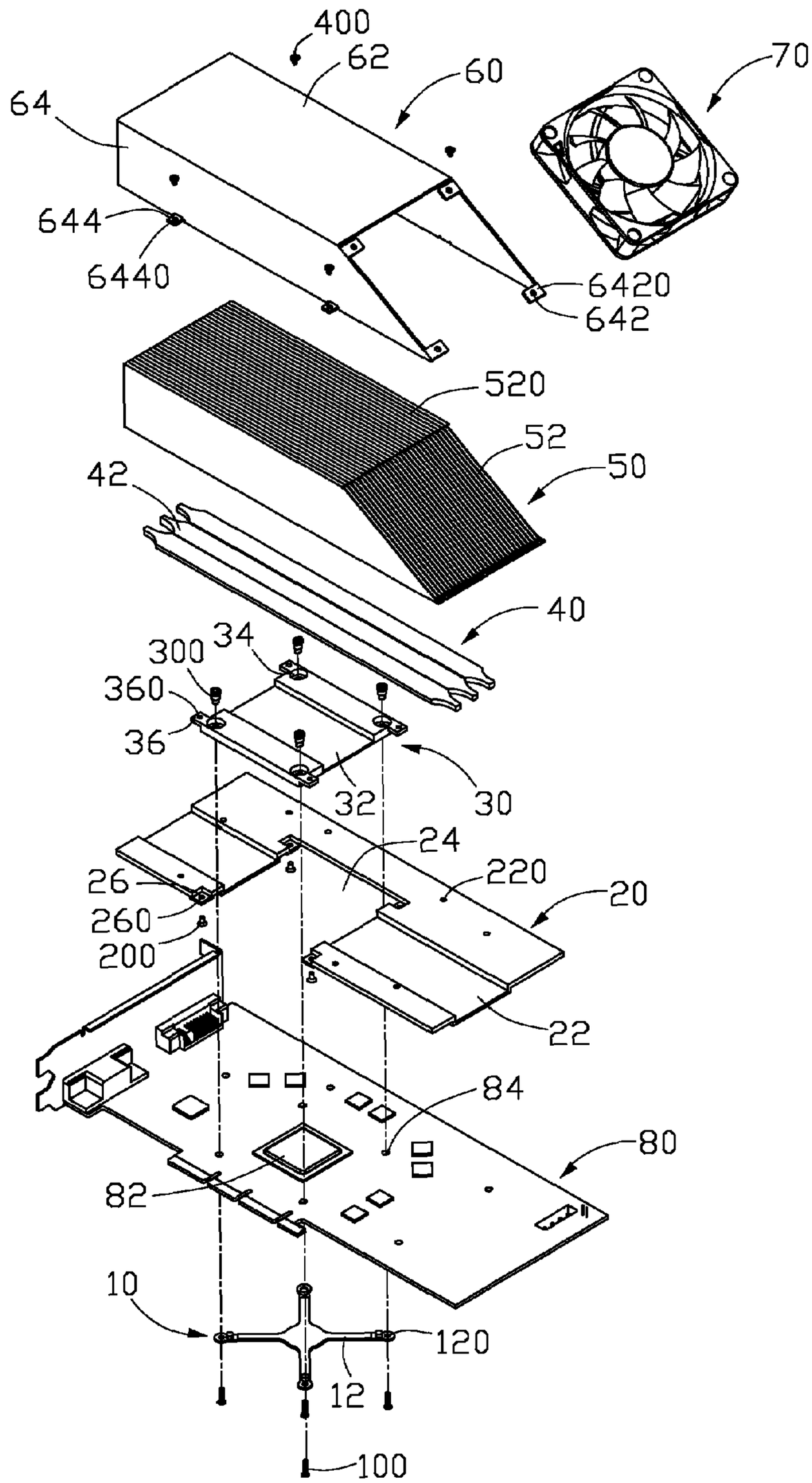

400
62
60
64
70
644
6440
6420
642
520
52
50
42
40
34
300
360
36
32
30
24
26
220
20
260
200
22
84
80
82
10
120
12
100

FIG. 2

HEAT DISSIPATION APPARATUS FOR HEAT PRODUCING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a heat dissipating apparatus for heat producing device and particularly to a heat dissipating apparatus mounted onto a processor such as, for example, a VGA (video graphics array) card, for dissipating heat generated during operation of the processor.

2. Description of Related Art

When electronic components operate at high speed they generate a mass of heat. Generally, it is desirable to employ a heat dissipating apparatus to remove the heat from these electronic components, to assure that the components function properly and reliably. A typical heat dissipating apparatus comprises a base for contacting the electronic component so as to absorb the heat generated by the electronic component, a plurality of fins extending from the base, and a centrifugal fan horizontally installed at a lateral side of the fins for providing airflow through the fins to remove the heat from the fins into ambient air.

Generally, space surrounding a computer add-on device such as a VGA card is quite limited, and the centrifugal fan of the heat dissipating apparatus horizontally fixed to the lateral side of the fins of the heat dissipating apparatus not only takes up a large area around the VGA card thus severely restricting the size of the fins, but also limits airflow to central areas of the base of the heat dissipating apparatus where most heat absorbed from the electronic component is accumulated, thereby inhibiting heat dissipating efficiency of the heat dissipating apparatus.

Accordingly, what is needed is a heat dissipating apparatus having a fan installed which doesn't restrict the size of the fins and allows airflow to be distributed to high temperature areas of the heat dissipating apparatus.

SUMMARY OF THE INVENTION

According to a preferred embodiment of the present invention, a heat dissipating apparatus configured for dissipating heat generated by heat producing device such as an add-on device, includes a base, a fin set and an axial fan. The base can be attached to the heat producing device and contacts with a heat producing element of the heat producing device, such as, for example, a processor in the add-on device. The fin set comprises a plurality of fins arranged on the base; the fins are spaced apart from and parallel to each other and form a plurality of air passages therebetween. The axial fan is installed on a lateral side of the fin set and blows airflow into the fin set through the air passages. The fin set defines an inclined plane at an end thereof, and the axial fan is installed on the inclined plane of the fin set and oblique to the base, whereby the axial fan can have a larger size to provide an airflow with a larger flow rate through the fins to effectively remove heat therefrom.

Other advantages and novel features of the present invention will become more apparent from the following detailed description of preferred embodiment when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an assembled view of a heat dissipating apparatus according to a preferred embodiment of the present invention, shown together with an exemplary add-on device having a processor; and

FIG. **2** is an exploded, isometric view of FIG. **1**.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. **1** and **2** show a heat dissipating apparatus in accordance with a preferred embodiment of the present invention. The heat dissipating apparatus is shown mounted on an exemplary add-on device **80** such as a VGA card for dissipating heat generated by a processor **82** mounted on the add-on device **80**. The heat dissipating apparatus includes a back plate **10** located beneath the add-on device **80**, a base (not labeled) in contact with the processor **82**, three heat pipes **40** disposed on the base, a fin set **50** arranged on the heat pipes **40**, a fan duct **60** covering the fin set **50** and an axial fan **70** installed at a lateral side of the fin set **50**.

The processor **82** is located in a central portion of the add-on device **80**. The add-on device **80** symmetrically defines four mounting holes **84** around the processor **82**, for allowing a plurality of screws **100** to extend therethrough to secure the heat dissipating apparatus thereon. A plurality of electronic components (not labeled) is located around the processor **82** on the add-on device **80**.

The back plate **10** is mounted below the add-on device **80** and is positioned corresponding to the processor **82**. The back plate **10** is integrally formed from a single piece of stainless steel. The back plate **10** has a central body (not labeled) and four fixing legs **12** symmetrically extending outwardly from four corners of the central body. The fixing legs **12** each defines a fixing hole **120** adjacent to a distal end thereof corresponding to the mounting hole **84** of the add-on device **80** for receiving the screw **100**.

The base of the heat dissipating apparatus comprises a first plate **20** and a second plate **30** engaged with the first plate **20**. The first plate **20** is substantially rectangular and made of a heat conductive material such as aluminum. The first plate **20** has a lengthways portion with a concave section, thereby defining a lengthways receiving groove **22** parallel and adjacent to a first lateral side (not labeled) thereof, for accommodating the heat pipes **40** therein. The first plate **20** defines a rectangular opening **24** extending from the first lateral side to a second lateral side (not labeled) opposite to the first lateral side until beyond the receiving groove **22**, for receiving the second plate **30**. The first plate **20** defines four rectangular step portions **26** respectively adjacent to four corners of the opening **24**. The step portions **26** are formed by stamping the first plate **20** downwards and each define a fixing orifice **260** therein. The first plate **20** defines two pairs of mounting orifices **220** around the opening **24** and adjacent to the first and second lateral sides thereof for fixing the fan duct **60** thereto by screws **400**.

The second plate **30** can be made of a heat conductive material with better heat conductivity than the first plate **20**, such as copper. The second plate **30** is substantially rectangular and has a configuration consistent with that of the opening **24** of the first plate **20**. The second plate **30** defines a receiving groove **32** in a middle portion thereof. The receiving groove **32** is located corresponding to and communicating with the receiving groove **22** of the first plate **20** when the second plate **30** is snugly accommodated in the opening **24** of the first plate **20**. The second plate **30** defines four through holes **34** in four respective corners thereof for receiving sleeves **300** therein. The sleeves **300** have screw thread formed on an inner face thereof for receiving the screws **100**, thus fixing the base on the add-on device **80**. Each sleeve **300** comprises a wide portion and a narrow portion. The through holes **34** each match a corresponding sleeve **300** and define a step therein for supporting the sleeve **300** thereon. The second plate **30** has two pairs of spaced fixing ears **36** extending outwards from respective ends of two opposite lateral sides

thereof. The fixing ears **36** each are rectangular and designed to be snugly supported on the corresponding step portions **26** of the first plate **20** and to hold top surfaces of the first and second plates **20**, **30** essentially level with each other. The fixing ears **36** each define a fixing orifice **360** therein corresponding to the fixing orifice **260** of the corresponding step portion **26** for engaging with screw **200** to secure the first and second plates **20**, **30** together.

The three heat pipes **40** each consist of elongated linear flat plates with capillary structure and phase-changeable media contained therein. The three heat pipes **42** are disposed side by side and thermally communicate with the receiving grooves **22**, **32** after being attached to the base. Top surfaces of the three heat pipes **42**, the first and second plates **20**, **30** form a plane face for supporting the fin set **50** thereon after they are assembled.

The fin set **50** comprises a plurality of the fins **52**. The fins **52** are spaced with each other and define a plurality of air passages therebetween. The fins **52** are held vertically on the plane face formed by the heat pipes **42** and the base, and parallel to the receiving grooves **22**, **32** of the base after the fin set **50** is attached to the base. Each fin **52** has a main body (not labeled) and two flanges **520** extending perpendicularly from parallel upper and lower edges of the main body. The body of each fin **52** is substantially trapezium in shape. Corresponding flanges **520** of the fins **52** cooperatively form a top plane face (not labeled) and a bottom plane face (not labeled) for thermally contacting with the base. The body of each fin **52** has a beveled edge connecting the top edge and the bottom edge thereof. The beveled edges of the fins **52** are parallel to each other and cooperatively define an inclined plane area at the lateral side of the fin set **50**. The inclined area is oriented at an acute angle to the base. The acute angle should be in an approximate range from 30-60 degrees for enabling the axial fan **70** installed onto the inclined area to direct airflow to the fins **52** and the second plate **30** where heat absorbed from the processor **82** accumulates.

The fan duct **60** covering the fins set **50**, comprises a top wall **62** parallel to and spaced from the base and two sidewalls **64** extending downwardly from two opposite lateral edges of the top wall **62**. The sidewalls **64** each define a beveled edge identical to that of the fins **52**. The beveled edges of the sidewalls **52** each have two rectangular tabs **6420** extending perpendicularly and inwardly from two ends thereof. The tabs **6420** each define a mounting orifice **642** therein for mating with a fan fixture (not shown) to mount the axial fan **70** on the inclined plane at the lateral ends of the fins **52** of the fins set **50**. The sidewalls **64** each have two spaced fixing eyelets **644** extending horizontally and outwardly from a bottom edge thereof. The fixing eyelets **644** each define a mounting orifice **6440** therein corresponding to the mounting orifice **220** of the first plate **20** for receiving the screw **400** to secure the fan duct **60** onto the first plate **20**.

In assembly, the second plate **30** is snugly received in the opening **24** of the first plate **20** with the fixing ears **36** supported by the step portions **26** of the first plate **20**. The heat pipes **42** are tightly received in the receiving grooves **22**, **32** of the base. The fin set **52** is thermally attached to the base and the heat pipes **42** via soldering. The fan duct **60** covers the fin set **50** and is secured to the base by the screws **400** extending through the fixing eyelets **644** of the fan duct **60** to engage into the mounting orifices **220** of the first plate **20**. The axial fan **70** is installed on the inclined area of the fin set **50** by the fan fixtures engaging in the mounting orifice **642** of the tabs **6420** of the fan duct **60**. The axial fan **70** is in this way slantwise installed on the lateral side of the fin set **50** and at an acute angle to the base.

In use, the base is secured on the add-on device **80** with a bottom surface of the second plate **30** held in intimate contact with the processor **82** by the screws **100** extending through the fixing holes **120** of the back plate **10**, the mounting holes **84** of the add-on device **80** and the fixing orifices **34** of the second plate **30** to engage with the sleeves **300**. Heat generated by the processor **82** is absorbed by the second plate **30**. Some of the heat in the second plate **30** is directly transferred to the fin set **50** and some is absorbed by the heat pipes **40** and is then transferred to the first plate **20** and the fin set **50**. The axial fan **70** at the lateral side of the fin set **50** provides forced airflow to the fins **52** of the fin set **50**. Because of the acute angle between the axial fan **70** and the base, the airflow from the axial fan **70** in the passages between the fins **52** is directed towards the base, more particularly toward the second plate **30** wherein more heat is accumulated, which results in the heat in the second plate **30**, portions of heat pipes **40** and middle portions of the fins **52** corresponding to the second plate **30** being directly removed by the airflow. Furthermore, since the inclined plane has an area larger than that when the plane is vertically defined, the axial fan **70** can have a larger size thereby providing the airflow through the fins **52** with a larger flow rate to effectively remove the heat from the fins **52**.

It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A heat dissipating apparatus adapted for dissipating heat generated by a heat producing device, comprising:

a base for contacting with a heat producing electronic element of the heat producing device;

a fin set located on the base, comprising a plurality of fins, a plurality of passages defined between the fins, each of the fins having two opposite edges and a lateral inclined edge connecting the two opposite edges, the inclined edges of the fins defining an inclined plane at a lateral side of the fin set;

an axial fan located on the inclined plane at the lateral side of the fin set and defining an acute angle to the base, for generating an airflow through the passages to the base; and

a plurality of straight flat heat pipes sandwiched between the fin set and the base;

wherein the base comprises a first plate and a second plate received in an opening defined in the first plate, the first plate and the second plate respectively define two corresponding receiving grooves communicating with each other; and

wherein the plurality of straight flat heat pipes is wholly received in the receiving grooves of the first plate and the second plate of the base and connected to a bottom surface of the fin set.

2. The heat dissipating apparatus as described in claim **1**, wherein the axial fan is inclined toward the base at an angle to the base in an approximate range from 30-60 degrees.

3. The heat dissipating apparatus as described in claim **1**, wherein the second plate is made of a material with higher heat conductivity than that of the first plate.

4. The heat dissipating apparatus as described in claim **3** wherein the first plate is made of aluminum.

5. The heat dissipating apparatus as described in claim 4 wherein the second plate is made of copper.

6. The heat dissipating apparatus as described in claim 1, further comprising a fan duct covering the fin set, wherein the fan duct has two beveled edges corresponding with the inclined plane of the fin set, and the beveled edges each have two rectangular tabs extending perpendicularly and inwardly from two ends thereof to secure the axial fan on the inclined plane.

7. A heat dissipating apparatus adapted for dissipating heat from a heat producing device, comprising:

a base for being secured on the heat producing device and thermally engaging with a heat generating electronic component of the heat producing device;

a fin set comprising a plurality of fins arranged on the base, the fins spaced and parallel to each other, wherein a plurality of air passages are defined between the fins;

an axial fan installed at a lateral side of the fin set for providing airflow to the fin set through the air passages; and

a plurality of straight flat heat pipes thermally connected with the base and the fins;

wherein the fin set defines an inclined area at an end thereof, the axial fan is installed on the inclined area of the fin set and inclined to the base;

wherein the base comprises a first plate and a second plate received in an opening defined in the first plate, the first plate and the second plate respectively define two corresponding receiving grooves communicating with each other; and

wherein the plurality of straight flat heat pipes is wholly received in the receiving grooves of the first plate and the second plate of the base and connected to a bottom surface of the fin set.

8. The heat dissipating apparatus as described in claim 7, wherein each of the fins of the fin set has an inclined edge at the lateral side of the fin set, the inclined edges of the fins cooperatively define the inclined area, and the axial fan is located on the inclined area.

9. The heat dissipating apparatus as described in claim 7, wherein the axial fan is oriented at an oblique angle to the base in an approximate range from 30-60 degrees.

10. The heat dissipating apparatus as described in claim 7, wherein the second plate is made of a more highly heat conductive material than that of the first plate.

11. The heat dissipating apparatus as described in claim 10, wherein the first and second plates are respectively made of aluminum and copper.

12. The heat dissipating apparatus as described in claim 7, further comprising a fan duct covering the fin set, the fan duct has two beveled edges corresponding to the inclined area of the fin set, and the beveled edges each extend two tabs for securing the axial fan on the inclined area.

13. A computer add-on card comprising:

a processor which generates heat when operates;

a base mounted on a top surface of the processor and thermally connecting therewith;

a plurality of fins extending upwardly from the base, wherein the fins each have an inclined lateral side, the inclined lateral sides cooperatively defining an inclined plane;

an axial fan mounted on the inclined plane and at an inclined angle to the base, an airflow generated by the axial fan flowing through the fins to the base; and

a plurality of straight flat heat pipe;

wherein the base comprises a first plate and a second plate received in an opening defined in the first plate, the first plate and the second plate respectively define two corresponding receiving grooves communicating with each other; and

wherein the plurality of straight flat heat pipes is wholly received in the receiving grooves of the first plate and the second plate of the base and connected to a bottom surface of the fin set.

14. The computer add-on card as described in claim 13 further comprising a fan duct covering the fins, the fan duct having a top wall on tops of the fins, front and rear walls extending downwardly from the top wall and covering front and rear sides of the fins, the front and rear walls each having an inclined lateral side, the axial fan being also mounted on the inclined lateral sides of the fan duct.

15. The computer add-on card as described in claim 14 wherein the second plate has a thermally conductivity higher than that of the first plate.

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